Alberta Forest Management Science Council

C.R.James (Chairman), V. Adamowicz, S.Hannon, W.Kessler,
P.Murphy, E. Prepas, J.Snyder, G.Weetman, M.A.Wilson

Statement of Account

To the Minister of Alberta Environment

The Honourable Gary Mar

The Alberta Forest Management Science Council

June, 99

Alberta Forest Management Science Council

C.R.James (Chairman), V. Adamowicz, S.Hannon, W.Kessler, P.Murphy, E. Prepas, J.Snyder, G.Weetman, M.A.Wilson

STATEMENT OF ACCOUNT

Executive Summary

The Minister of Environment of the Government of Alberta established the Alberta Forest Management Science Council in 1996 and since that time the Council has made a number of important scientific contributions to the Province on the science of forest management. These contributions, which are discussed in the text, include:

- Supporting the Canadian Standards Association review in developing a systematic approach towards Sustainable Forest Management through a certification process.
- Endorsing as scientifically sound, the framework and strategic directions of the Alberta Forest Conservation Strategy.
- Developing a scientifically based timber supply protocol for Sustainable Forest Management. The findings were presented in the document entitled "Sustainable Forest Management and Its Major Elements." The work was given an extensive peer review and many of the recommendations of the reviewers were incorporated into the final document.
- Presenting to the Rocky Mountain Section of the Canadian Institute of Forestry the Council's protocol document.
- Completion of a Desired Future Forest Concept
- Recommendations for the transition to Sustainable Forest Management in Alberta
- Consulting widely with scientists, industry and government on the scientific issues associated with Sustainable Forest Management.

In the text to follow the role of the Science Council is examined and recommendations on its future are presented.

100-03396/

Alberta Forest Management Science Council

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STATEMENT OF ACCOUNT

INTRODUCTION

THE FORMATION AND TERMS OF REFERENCE

The Minister of Environment of the Government of Alberta announced the establishment of the Alberta Forest Management Science Council at Government House in March 1996. He appointed scientists with diverse and relevant backgrounds to provide scientific advice to the Department of Environment on science matters pertaining to forest management. In particular, the Council was appointed to provide information to the Assistant Deputy Ministers of the Land and Forest Service and the Natural Resources Service on the science required for better sustainable forest management in the province of Alberta. The Council was requested to focus on the need to change from contemporary forest management to one more directed to sustaining both forest ecosystems and the economy. In addition, the Council was asked to provide scientific advice on how to more effectively involve Albertans in the process of decision making on forest management issues. The Council membership is:

1. Dr. Vic Adamowicz - Socio-Economist
2. Dr. Susan Hannon - Ecology and Biodiversity
3. Dr. Robert James - Chairman
4. Dr. Winifred Kessler - Forest Policy & Planning
5. Dr. Peter Murphy - Forest Policy and Wildfire
6. Dr. Ellie Prepas - Forest Aquatics
7. Dr. Joan Snyder - Forest Ecologist; former Alberta Forest Conservation Strategy Steering Committee member
8. Dr. Gordon Weetman - Silviculture
9. Dr. Malcolm Wilson - Chemist

The Council was established to provide the Government with the expertise developed by the scientific community in Alberta, and in Canada and abroad by developing and maintaining a science network. The expectation was that Council would develop new networks as required to insure that the science-based forest management in the province of Alberta is sound.

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WORKPLAN AND OPERATING RULES

The Council developed a workplan and published it. The workplan's initial tasks involved developing operating rules which included the appointment of a chairman, methods for covering expenses and renumeration, ground rules for meetings, decisions on communications (e-mail/fax), information requirements and the expectations of the Council with regard to the Department of Environment. The workplan went on to include a review of integrated resource management and forest practices in the province, a self learning program, the holding of strategic workshops and retreats, a building of a network, and the development of a peer review process.

THE WORKPLAN – WHAT HAS BEEN ACHIEVED

The Canadian Standards Association (CSA) Review

The AFMSC supported the CSA Sustainable Forest Management (SFM) system approach described in documents Z808 and Z809 as a significant first step in describing a system through which advances towards SFM may be achieved and registration for a defined forest area may be granted.

The AFMSC recommended that following twelve points be given particular scrutiny as the CSA/SFM system is applied in Alberta and the points are given Appendix 1- AFMSC Statement and Recommendations.

The Review of the Alberta Forest Conservation Strategy (AFCS)

June 1996 Draft

The AFMSC endorsed the framework and strategic directions of the AFCS as scientifically sound. (See Appendix 2-AFMSC Statement).

The AFMSC recommended that because of the need for clarification that the second sentence of the Precautionary Principle as outlined in AFCS needs to be modified or deleted. Furthermore, AFMSC presented seven recommendations regarding ecological management and six recommendations regarding socio-economic science.

AFMSC also stressed that a mechanism be put in place that insures that the AFCS is not a static, but a dynamic document, focussing as much on the generation and scientific validation of new directions as it does on the implementation of the old. AFMSC suggested that AFCS itself be subject to periodic review – say every five years.

The Timber Supply Protocol

The AFMSC developed a timber supply protocol (See Appendix 3 - Sustainable Forest Management its Major Elements) at the request of the Director of Forest Management and revised the definition of Sustainable Forest Management:

"The maintenance of the ecological integrity of the forest ecosystem while providing for social and economic values such as ecosystems services, economic, social and cultural opportunities for the benefit of present and future generations."

The definition is based on the concepts of ecological integrity and social and economic values. These concepts are compatible with national and international definitions of sustainable forest management. They are applied through a five-element protocol that integrates these two concepts, with timber supply assessed as one output. The five elements of the protocol proposed for achieving sustainable forest management are:

1. Ecological Integrity and Inherent Disturbance.

The conservation of ecological integrity of the forest is a necessary condition for the sound and sustainable management of the forest.

2. Desired Future Forest

Defining a vision of a desired future forest in Alberta is a necessary step in implementing a more sustainable forest management program.

3. Social and Economic Values and Public Involvement

Social and economic values determined with public input are integral to the selection and attainment of the desired future forest.

4. Scales – Spatial and Temporal

The temporal and spatial scales used to manage the forest must be consistent with the scales of disturbances and processes inherent to the forest and social scales relevant to forest resource use.

5. Adaptive Management

Adaptive management monitors progress towards the desired future forest, continually improves the knowledge base and adjusts actions to correct for deviations.

For each element the Council provided a statement on the

1. Rationale

2. Implications

3. Science Requirements

In arriving at the Protocol the Council discussed sustainable forest management with some of Alberta's leading forest companies as well as other provincial governments. The Council met with Dr. Jack Ward Thomas, Boone Crockett Wildlife Professor and former Chief of the U.S. Forest Service at a Retreat. The protocol document was peer reviewed by the following people:

Bob Andrews, Director, Wildlife Alberta Environment; Dr. Gordon Baskerville, Professor of Forestry, UBC; Dr. Tom Beckley, Canadian Forest Service; Ms. Lea Bill, Community Health, Sisksika Nation; Dr. Clark Binkley, Dean of Forestry, UBC; Dr. Bill Fuller, Professor Emeritus, UofA; Dr. Daryll Hebert; Alberta Pacific Industries; Mr. George Weyerhaeuser, Mr. Bruce MacMillan, Dr. Luigi Morgantini, Weyerhaeuser Canada; Mr. David Neave, Executive Director, Wildlife Habitat Canada; Dr. Brad Stelfox, Forem Consulting; Dr. Jack Ward Thomas ; Dr. Terry Veeman, Professor Rural Economy, UofA.

The Canadian Institute of Forestry Presentation

On January 23, 1998 Council made a presentation to the Rocky Mountain Section of the Canadian Institute of Forestry on the Council's document entitled "Sustainable Forest Management and Its Major Elements" along with supporting material.

Over two hundred members of the Institute attended the meeting that involved the Council presentations and frank feedback from those attending. Presentations were given on:

1. The Alberta Forest Conservation Strategy.

2. The steps needed to proceed towards sustainable forest management.

3. Ecological integrity and Alberta's inherent disturbance regime.

4. The steps taken by the province towards adaptive management.

5. How to proceed to determine a desired future forest.

6. Social and economic values along with material on public involvement and scales.

7. Research topics relating to the elements of the protocol.

8. The role of adaptive management in the protocol.

Challenges for Sustainable Forest Management

A set of ten recommendations are presented on the implementation of SFM and they are given in Appendix 4.

Desired Future Forest

Following the presentations to the Rocky Mountain Section of the Canadian Institute of Forestry, the Council was requested to provide guidance in the development of a Desired Future Forest.

The council has developed a document that provides basic definitions and an example for consideration by the Department of Environment as a model on which to base a more complete definition of a Desired Future Forest. In the view of the Council, it is important to start with the "end in mind" - a clearly defined Desired Future Forest that is compelling to Albertans.

The document (See Appendix 5) is divided into three parts:

1. Basic Definitions and Key Steps

2. A Model of a Desired Future Forest

3. A Cost/Benefit Assessment for

   - planning

   - implementation

   - ongoing activities

DEPARTMENTAL SUPPORT

All Council members were very appreciative of the enthusiastic support and co-operation received from departmental staff while fully recognizing the limitations of resources of the department due to the many other commitments of departmental staff outside the Council. The staff made many important contributions to the deliberations of Council.

EXPENDITURES

Item	**Cost** [1]
Direct Costs	
Councillors	$255,500
Travel	$11,295
Meeting Facilities and Hosting	$9,160
Indirect Costs	
Secretariat	$48,000
Companies	$12,000
Other governments	$10,000
Total	**$345,955**

RECOMMENDED ROLE OF THE SCIENCE COUNCIL

On the need for a Science Council

1. Members of the Science Council believe a strong need exists to have a Science Council. One of the most important outcomes of the Science Council activities was the bringing together of many different relevant disciplines. The ensuing interaction of members resulted in an inter-educational program, which brought about a

[1] Costs are estimated over the life of the Council; roughly 2.5 years. Costs are estimates; final numbers will not be available until April, 1999.

synergism that developed into an important scientific resource for the province. Such a resource can provide significant scientific advice on the management of Alberta's forests and can be of assistance in the understanding of the consequences, benefits and risks resulting from management actions. Any future Science Council should continue to contribute to this legacy. Other reasons members gave for the need are to:

- Provide an independent, scientific view on issues surrounding sustainable forest management that will assist in reaching credible decisions.
- Provide scientific advice on ways to determine, through consultation and participation, what products and values (objectives) are preferred by the public.
- Show scientific ways to predict various scenarios depicting Desired Future Forests, to advise on the probable outcome of various scenarios or management actions and to aid in reaching decisions on these alternatives.
- Provide advice on defining criteria and indicators on monitoring and reporting systems.
- Advise on the research needed to more effectively realize sustainable forest management.
- Keep Alberta abreast of/and in the forefront of forestry/land management practices that maintain ecosystem values and function, particularly as the industry is consolidated and enhanced
- Advise on how a desired future landscape is constructed with meaningful input from aboriginal and western culture.
- Offer input into the process involved with policy.
- The relationship between the Council and Albertans needs to be developed through the Ministry of Environment following proper process. In this context Council could:
  - Provide scientific education to Albertans through presentations and written communication.
  - Aid, through providing scientific support, in carrying the message of SFM to the forest industry, government, forest communities, environmental groups,

oil and gas sector, ranchers, recreationalist, the tourism sector and other land users.

- Provide the steps to achieve a scientifically based forest management strategy and assist in the implementation/evaluation/development of those strategies.

- Advise on the probable results of forest management actions, provide interpretations to managers and the public, and recommend on options for adjustment of actions to achieve desired results.

3. The recommended next tasks of a future Science Council are to:

- Propose to government, ways in which science can assist in the shift to SFM.

- Provide input on the increasing scientific data base on which to manage the forest.

- Provide scientific guidance on the implementation of sustainable forest management for the mountains, foothills and boreal forests of Alberta.

- Undertake a scientific review of the implications of current government policies and regulations and any revision of "ground rules".

- Provide from a science perspective an interpretation of the principles and policies of sustainable forest management.

- Review the science and technology plan of the Canadian Council of Forest Ministers and the Alberta Forest Research Advisory Council to provide recommendations on how it relates to Alberta.

- Review the issue of carbon cycling and how it relates to sustainable forest management.

- Provide scientific support on the financial issues to be considered for alternative approaches to sustainable forest management.

- Investigate the implications of disturbance management strategies on sustainable land use.

- Examine forest management plans to determine that they demonstrate sustainability, are spatially explicit and incorporate the "scientific principles" advocated by Council.

- Examine the public participation process in Alberta and how it effectively incorporates the democratic methods and includes "values" in landscape planning and zoning.

- Make recommendation to improve the scientific credibility and scientific basis of forest management decisions. One mechanism might be to establish an independent forest management commission with a mandate for approving landscape plans.

4. Reporting Structure of the Next Science Council

New Science Council should report to the Department of Environment. The appointments to the Council should be made through a Ministerial Order as was done for the current Council.

5. Support Structure of Next Science Council

All members of the current Science Council favour the continuation of the current support structure for any new Science Council. Everyone believed a future Science Council should be funded by government and have its support functions handled by government employees.

CRITERIA FOR APPOINTING COUNCIL MEMBERS

- A systematic approach for choosing Council members from a variety of scientific disciplines, needs to be explored. A system needs to be in place that ensure that the Council members are leading scientists in their field and are committed within an appropriate time frame to making a substantive contribution to the scientific issues at hand. One such approach would be to have Environment appoint a search committee composed of individuals highly knowledgeable of the leading scientists in the disciplines associated with forest management. The committee should have strong representation from the academic sector. Upon completing the search, the committee would recommend to Environment appointments to the Science Council.

- The Council proposes the following scientific disciplines for consideration in the formation of a new Science Council:

- Socio-economics particularly non-timber values

- Forest policy and planning

- Inherent disturbance and forest policy

- Water/aquatics/watershed
- Forest ecology and biodiversity
- Traditional knowledge and social science
- Global earth science & mathematics
- Industrial ecologist knowledgeable in fibre processing and waste management technologies
- Silviculture
- Forest Management
- The chair of the Council must have the scientific understanding required to move the area/issues forward and should be selected by Council members.

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Statement of Account

Appendices

Alberta Forest Management Science Council

Appendix 1: Canadian Standards Association Review

Alberta Forest Management Science Council

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Introduction

Review of the Canadian Standard Association certification process was an introductory exercise for the Council. The standards were well along in their development when the Science Council was asked to review them.

Recommendation

1. The Canadian Standards Association must strive to establish and maintain a strong linkage with the International Standards Organisation if it is to have an impact on present and future markets and prices. It must broaden its focus to include those products that might substitute for forest products or substitute production from other, potentially non-sustainable regions. The system should also monitor other certification standards and revise CSA processes if improvements or advancements are implemented in other schemes.
2. The system must incorporate temporal and risk based concepts in the assessment of sustainability. Concerns about current practices and their impacts on risks of significant future losses should be considerations in the assessment. For example if current management practices appear to be leading to high probability of significant fire losses or pest damage, these serious risks should play a role in the assessment of the sustainability of the process. Sustainability should be reviewed in terms of the expected future time paths of the factors of interest (economic, social and ecological elements) as well as the variance and probability of significant losses along these time paths. These concepts should be addressed through selected indicators.
3. The Defined Forest Areas (DFAs) should be large enough to reflect the ecosystem at a landscape scale, particularly with respect to forest health, biological diversity and watersheds. Private woodland owners should be encouraged to apply for certification through woodland owner associations that would result in larger areas. Where small units choose to be certified, government guidance on landscape scale concerns should be encouraged.
4. In cases where there are two or more industries with harvesting rights on DFA, government involvement should be requested in order to encourage all industries with harvesting rights to collaborate with the applicant in the certification process.
5. Even on larger DFAs, considerations for sustainable forest management should extend beyond their borders, particularly with respect to nomadic or migratory species whose population viability may be affected by activities within the DFA. Government should be encouraged to play a guiding role in assessing impacts on or from these surrounding areas. Other considerations may include ecosystem health, watershed integrity, and protected areas.
6. Public participation is a vital element in the CSA/SFM process. However, a better definition of public, the breadth of its representation, and the role of the public in decision-making should be more clearly defined.
7. Definition of suitable indicators is fundamentally important to determination of whether or not sustainability is being achieved for identified values. Values are identified through public consultation. However, involvement of appropriate scientific expertise in defining suitable indicators should be required, in addition to public participation.
8. The CSA/SFM documents do not recognize that current government regulations or legislation may hamper or prevent achievement of all SFM requirements such as those listed for the CCFM Criteria or others identified locally. This is a serious omission that suggests that conformance to existing legislation is paramount, regardless of its applicability to DFA-specific situations. There must be recognition of this possibility, and a suggested means by which appropriate changes can be affected.

Recommendation

9. Consideration of all forest values will require more detailed inventories, at least with respect to concerns in specific areas. Governments should play a facilitating róle by providing guidelines for inventories.
10. The auditing team plays an essential role in determining whether or not sustainable forest management is being achieved. The documents should be more explicit about the composition of the auditing team, especially with respect to including auditors with expertise in biodiversity and ecosystem health. Credentials of auditors must be of superior standard, if not of blue ribbon quality. Their impartiality must be unquestionable.
11. The initial applicants for certification will be pioneers of the system. They will have a demanding task to address all the components of the SFM system, and will establish important precedents as a result of their decisions. AFMSC recommends that the initial applications in Alberta, perhaps one large and one small, be viewed as case studies using a team approach, perhaps involving AFMSC and its network as a resource to enhance learning by doing.
12. The system must ensure that the validity of the Canadian Criteria and Indicators are continually questioned and updated based on the most recent scientific knowledge.

Alberta Forest Management Science Council

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Appendix 2: Review of the Alberta Forest Conservation Strategy

Alberta Forest Management Science Council

C.R.James (Chairman), V. Adamowicz, S.Hannon, W.Kessler, P.Murphy, E. Prepas, J.Snyder, G.Weetman, M.Wilson

Mr. Cliff Henderson
Assistant Deputy Minister of the Land and Forest Service

and

Mr. Jim Nichols
Assistant Deputy Minister of the Natural Resources Service

Dear Mr. Henderson and Mr. Nichols,

Subject: The Alberta Forest Conservation Strategy Draft

The Alberta Forest Management Science Council was requested by the Director of Forest Management to review the Alberta Forest Conservation Strategy June draft and to advise the department on the scientific basis for new directions for forest management.

The Council commends all groups involved in the development of the Strategy for their time and effort, innovation and commitment to forest conservation in Alberta. The Steering Committee has put together a document that defines the framework and strategic directions of forest conservation in this province.

The Alberta Forest Conservation Strategy is an excellent first step to focus Albertans on important forest issues that affect them and their children and to show them how they should be addressed. It should not stop with the completion of the document. We urge you to consider a continued focus on forest management that involves Albertans in a constructive dialogue about forest sustainability and elicits their support for the further details that require resolution.

It is the view of the Council that if the AFCS is an evolving process, then the level of detail in the Strategy is sufficient. If it is a one time process it does not go far enough.

The Council endorses the framework and strategic directions as sound scientifically but recommends some changes in the strategy to make it consistent with the science of forest management as we know it. Our recommendations for change are made in the attached pages.

Sincerely,

C.R.James
Chairman,
Alberta Forest Management Science Council

Alberta Forest Management Science Council

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Statement

The Alberta Forest Management Science Council endorses the framework and strategic directions of the Alberta Forest Conservation Strategy June 1996 Draft as scientifically sound.

Discussion

The strategy invokes key scientific and management principles that must become an integral part of forest policy, management and policy instruments. These include the principle that forests are complex ecosystems; that ecological integrity and biological diversity are fundamental to sustainability and long-term productivity of forest ecosystems; that uncertainty is an inherent quality of these systems, necessitating a precautionary approach through adaptive management. It recognizes that forest enterprises contribute substantially to the provincial economy, that many of our regional economies are dependent on forests, and that a sustainable forest economy requires a sustainable forest.

The consultative process followed by the Alberta Forest Conservation Strategy should ensure a high likelihood of being socially acceptable. Diverse perspectives appear to have been represented in the development of the strategy, The framework focuses on identified core values that were used as a foundation to craft the vision for Alberta's forests.

Recommendation regarding Principles

The Council is not clear on how the Precautionary Principle as outlined in the AFCS could be implemented. We agree with the first sentence as long as it is applied in the context of adaptive management. We recommend that the second sentence be modified or deleted.

Recommendations regarding Ecological Management

Ecological management, as outlined by the Steering Committee, represents an advance over conventional forest management with respect to consideration of broader forest ecosystem values. Although well-intentioned, sustained yield principles focussed on timber production in the assumption that other values would be inherent. In ecological management, values are identified through public participation and addressed as part of the planning process. This approach should result in more responsible and responsive stewardship. Recommendations include:

1. A clearer definition of Ecological Management is needed that clarifies the concept that ecosystems do not "manage" themselves since management is an activity of humans, and that recognizes that human activities cannot substitute for ecological processes but can emulate them over the range of natural variation inherent in the system.

2. The purpose of benchmarks and their role in the conservation of forests should be clearly stated. The council does not understand the scientific basis for implying that the existing Special Places 2000 program will be sufficient and recommends that no limit be specified at this time. It will be an important implementation activity.

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3. The use of monitoring and indicators requires definition both in terms of Alberta forest conservation and Alberta's relation to national and international communities. We suggest that the CCFM Criteria are a good starting point for discussion and that the need for the definition of provincial and local indicators be mentioned as part of the implementation section of the document.

4. The role of research should be clarified to ensure that new ways of forest conservation are studied by qualified and objective scientists, while also allowing better investment in the research required for adaptive management.

5. A continuing effort should be made to monitor the costs and benefits associated with implementation of ecological management and to search for cost effective management strategies.

6. The Draft puts considerable reliance on the use of ecosystem disturbance as a new model for forest management. That emphasis important to a more ecological approach and it is good to see the recognition of natural disturbance in the Draft. The importance of natural disturbance as a guide for forest management is currently being tested through the Network of Centres of Excellence in Sustainable Forest Management. In our view it is an untested hypothesis therefore, we suggest that the emphasis be expanded to include the full range of ecosystem dynamics that affect forest resilience and human impact. For example, the draft should increase its emphasis on the conservation of soil and water. Underlying all attributes of forests is the productivity of the soil and its critical role in nutrient cycling and energy flow in terrestrial ecosystems.

7. We agree with the concept of management by intensity of use. The management of the four intensities of use is akin to the management of portfolios where different benefits are delivered by each segment that contributes to better conservation of the whole. This should be undertaken using a combination of fixed and rotating intensities of use. The concept should be expanded to consider the long-term interaction of the four that will affect disturbance cycles and ecological management of different forest landscapes.

In summary, the Science Council agrees with the strategic directions encompassed in Ecological Management will result in better forest management in the province.

Recommendations re: Socio- economic science

The council is also in agreement with the directions outlined in Sustainable Forest Economy and Partnerships and Participation. A more systematic approach to understanding human preferences will lead us to better outcomes. Rather than treat this component as "other than science", we suggest that the adaptive management principle works equally well in the socio-economic arena.

1. Within its vision, principles and strategic direction, there needs to be a greater emphasis on the international aspects of forest management in Alberta.

2. The treatment of economic instruments in the draft needs to be more specific and consider such issues as modifications to tenure systems and examinations of market mechanisms for the allocation of timber and non-timber products. The Council agrees that the use of economic instruments can be shown to be effective in some sectors. More specifics are required before they can be validated for

use in the management of Alberta's forests. A more scientific approach is required, with testing of various approaches attempted and quantified.

3. Greater definition of economic indicators and their purpose is needed. Concepts or criteria could be stated now -- such as the CCFM Criteria -- but details need to evolve locally and regionally through public participation.

4. The scientific literature on public choice and involvement is richer than just the community advisory committees suggested in the draft. New mechanisms for public involvement such as value juries and other preference elicitation methods should be investigated in the implementation of the strategy. A stronger focus on scientific experiment in public choice and involvement is needed.

5. The same comment is applicable to aboriginal issues. Evolution of involvement of aboriginal peoples in the decisions that affect them, with the clear goal of a recognition of their rights through treaty and legislation is required. Various choice and participation mechanisms should be explored through the implementation of the strategy.

6. The strategy needs to point more strongly to the need for experimentation and the development of new science and its application in forest management. What is clear is that we do not know the best way to plan, work and live in the forest today in a way that does not compromise the use of the forest for our children. Only the rigorous application of science through adaptive management will allow us that assurance.

The socio-economic elements of the forest must be balanced by its dependence on productive and resilient forest ecosystems.

Recommendations regarding Implementation

The science of negotiation suggests that strategies like the AFCS will not succeed in the conservation of Alberta's forest if the strategy is not re-evaluated periodically and allowed to evolve. Continuing focus on forest issues and their resolution is required. The Steering Committee should put in place a mechanism that insures that the AFCS is not a static, but a dynamic document, focussing as much on the generation and scientific validation of new directions as it does on the implementation of the old. We suggest that the AFCS itself be subject to periodic review - say every five years.

Appendix 3: Sustainable Forest Management and its Major Elements

Alberta Forest Management
Science Council

C.R.James (Chairman), V. Adamowicz, S.Hannon, W.Kessler, P.Murphy, E. Prepas, J.Snyder, G.Weetman, M.A.Wilson

September 10, 1997

Mr. C.J. Henderson
Assistant Deputy Minister
Land and Forest Service
10th Fl, South Petroleum Plaza
9915 - 108 Street
Edmonton, Alberta
T5K 2G8

Dear Mr Henderson:

On behalf of the Alberta Forest Management Science Council, appointed by Ministerial Order 96/15, I forward to you a report entitled "Sustainable Forest Management - Advice on Timber Supply Protocols to the Land and Forest Service". The Council undertook the work starting in September 1996. The advice represents the work of 9 senior scientists from the Universities of Alberta, Northern British Columbia and British Columbia, Grande Prairie Regional College and the Alberta Research Council. It is the first substantial work of the Science Council.

The Process

To develop its recommendation, the Council reviewed the approach to the assessment of timber supply of some of Canada's Model Forests and some of Alberta's wood products companies. The Council also reviewed the various provincial approaches to timber supply and, in March of this year, held a retreat with Dr. Jack Ward Thomas, former Chief of the US Forest Service, to investigate some of the US issues regarding timber supply.

Finally, the Council circulated a draft copy of their supply protocols for peer review.

Key findings

In the report, the Council provides a revised definition of Sustainable Forest Management for your consideration. The definition is based on the concepts of ecological integrity and social and economic values. These concepts are compatible with national and international definitions of sustainable forest management in our view. They are applied through a 5 element protocol that integrates these two concepts with timber supply assessed as one output.

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Next Steps

The Council suggests that a preliminary feasibility analysis be undertaken to assess the protocol before it is implemented on a pilot basis.

Conclusions

Over the course of our work we were impressed by the commitment to Sustainable Forest Management by companies and provinces. None used Timber Supply as an input to their planning efforts; all calculated timber supply as an outcome after important forest ecological integrity, social and economic values had been addressed. It is unfortunate that Albertans as a whole could not have attended the presentations, particularly those of Alberta's wood products companies. They would have been proud, I think, of the significant commitment of these companies to a more sustainable form of forest management.

I and the other members of the Council have enjoyed the opportunity to review and provide advice to your government on timber supply. During the course of our work, we received many favourable comments that Alberta is on the right track to a more Sustainable Forest Management.

I look forward to meeting with you in the fall to review our work and to get on with our next task.

Sincerely,

C.R. James

Alberta Forest Management Science Council

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Alberta Forest Management Science Council

SUSTAINABLE FOREST MANAGEMENT

AND ITS

MAJOR ELEMENTS

Advice to the Land and Forest Service
on
Timber Supply Protocols

September 10, 1997

Alberta Forest Management Science Council

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SCIENTIFIC CHALLENGE

The Government of Alberta, as a signatory to the Canada Forest Accord in 1992, committed itself to work to implementing Sustainable Forest Management (SFM). It began the process by working through the Canadian Council of Forest Ministers to define SFM through Criteria and Indicators, published in 1995 (CCFM 1995) and through the development of the Alberta Forest Conservation Strategy (AFCS), recently forwarded to the Minister of Environmental Protection (May 1997). In 1996 it created the Alberta Forest Management Science Council (AFMSC) through the Minister for Environmental Protection. The group has reviewed a number of Forest Management issues. In the fall of 1996 the Director of Forest Management requested:

"That the Alberta Forest Management Science Council provide advice to the Land and Forest Service on Timber Supply Protocols, particularly the science base required to change from Sustained Yield Management to Sustainable Forest Management. I request that the Council develop:

> *A clear, science-based definition of Sustainable Forest Management for application in Alberta that would meet our obligation to the Canada Forest Accord, incorporate the principles, goal and vision of the current Alberta Forest Conservation Strategy and that would be recognized internationally.*
>
> *The elements of a Timber Supply Protocol that would meet the definition and be applicable to Alberta's forests.*
>
> *An assessment of the science-base required to change from our current sustained yield forest management."*

COUNCIL RESPONSE

The following response of the AFMSC was drafted in September 1997, following a year of review of documents, presentations and discussions. The response comprises a definition of SFM and description of five important elements.

The elements described provide government a science-base for a new timber supply protocol that conforms with the definition of Sustainable Forest Management.

The Council recognizes that uncertainty exists in terms of the science base of ecological integrity as well as social and economic values. Uncertainty also exists in their forecast. The elements of the protocol provide a framework under which uncertainty can be incorporated into forest management.

Alberta Forest Management Science Council

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A. DEFINITION OF SUSTAINABLE FOREST MANAGEMENT

The Alberta Forest Management Science Council defines Sustainable Forest Management as:

> *"The maintenance of the ecological integrity of the forest ecosystem while providing for social and economic values such as ecosystem services, economic, social and cultural opportunities for the benefit of present and future generations[1]".*

B. ELEMENTS OF SUSTAINABLE FOREST MANAGEMENT

The Council regards the maintenance of ecosystem integrity as an essential goal for the sound and sustainable management of Alberta's forests. Knowledge about ecosystem processes, including disturbance ecology and resilience to disturbance, provides the necessary context to identify a Desired Future Forest based on a range of possible scenarios. Social and economic values may be identified, quantified, and addressed through public involvement processes. Analysis and planning to reconcile social and economic values with ecological realities must occur at a variety of temporal and spatial scales. Our ability to achieve the desired future forest is constrained by inherent uncertainties within ecological and human systems as well as our limited understanding; therefore, an adaptive management approach is required for the sustainable future of Alberta's forests.

1. Ecological Integrity And Inherent Disturbance

THE CONSERVATION OF ECOLOGICAL INTEGRITY OF THE FOREST IS A NECESSARY CONDITION FOR THE SOUND AND SUSTAINABLE MANAGEMENT OF THE FOREST.

Ecological management of the forest develops and applies understanding of how forest ecosystems sustain themselves over long periods of time. It involves examination of growth, development, and the inherent disturbances that underlie the ecological integrity, dynamics, biological diversity and resilience of forest ecosystems. The knowledge enables managers to develop approaches that work with, rather than against, the processes that underlie forest ecosystem sustainabilty.

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1 The current definition as adopted does not include "for the benefit of all living things, locally, provincially, nationally and globally" from the AFCS and CCFM definition because what may be to the benefit of one living thing may be to the detriment of another.

"Long term health of forest ecosystems" as described in the CCFM definition puts too human a focus on forest ecosystems. "The maintenance of ecological integrity of the forest ecosystem" focuses more appropriately on the processes, flows, structures and range of variation of forest ecosystems.

"Environmental opportunities" as stated in the AFCS and CCFM definition is unclear to the Council. Ecosystem services, that provide outputs such as clear water and air, are clearly beneficial to present and future generations.

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1.1 Rationale

1.1.1 Inherent Disturbance

Alberta's forests have developed since the retreat of the glaciers. The plants, animals and micro-organisms that comprise Alberta's forest ecosystems have adapted within environments characterized by recurrent and often severe disturbances. Inherent sources of disturbance include wildfire, wind, floods, climate change, mass wasting, insects, disease and indigenous human use.

Moreover, the current level of human activity affects inherent disturbance processes, leading to conditions in forest structure, composition and landscape pattern that in some cases lie outside the typical range of variation of the system. For example, fire suppression during the last 40 years is believed to have changed the rate of fire disturbance of Alberta's forests (Murphy 1985). Understanding the relationships between disturbance types and managing to maintain ecological processes within the typical range of variation (Haila etal 1994, Haila 1994), are essential to the long-term sustainability of Alberta's diverse forest ecosystems.

Changes to Alberta's forest landscape are not limited to those activities associated with inherent disturbance. Further changes are being wrought by agricultural clearing, urban expansion, livestock grazing, oil and gas development, mining, road construction, introduction of exotic species, climate change and airborne contaminants. The rate of change is fuelled by Alberta's human population growth - an increase of 50-fold in the last 100 years - and the accompanying escalating increases in consumption of resources.

1.1.2 Ecological Management

An ecological approach aims to maintain forest structures, patterns, diversity and processes within the range of variation characteristic of the inherent disturbance regime of the forest. Science has key roles to develop understanding of the disturbance regime of Alberta's forest regions, and to identify the range of variation of key processes within which a variety of management objectives may be pursued.

Ecological management enlarges the focus of management from sustaining yield of specific tree fibre to the long-term maintenance of the system's ecological integrity and productivity. An ecological approach includes the following objectives:

- to maintain key ecosystem processes characteristic of the forest
- to conserve native biodiversity characteristic of the forest
- to manage human disturbance to maintain ecological patterns and processes within their typical range of variation.
- to manage fire disturbance within an acceptable level of risk to human life and property.

1.2 Implications

- Sustainable management includes a comprehensive approach to disturbance that strives to maintain the ecological integrity of the forest while effectively managing risk to human life, property and values,

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including timber supply.

- In ecological management, patterns and ranges of inherent disturbances both terrestrial and aquatic, may provide a conceptual model for management strategies. For example, current practices such as two pass harvesting and reforestation can be modified to more closely approximate the change to forests resulting from fire and forest succession.
- Although fire is part of the forest, wildfires pose threats to human life and property, especially in the urban interface. Ecological management will require a broader approach to fire management including landscape solutions. For example, harvesting schedules need to be arranged to remove high risk stands first or spatially arrange harvests to reduce risk of loss.
- Management for ecological integrity requires an understanding of forest change with age and site characteristics, particular to each forest region. Management systems such as tenure, planning and operations would be designed to maintain ecological integrity. eg. the Boreal Mixedwood would be managed as a mixedwood forest, not separate deciduous and coniferous allotments.

1.3 Science Requirements

- Research is underway in Alberta in both aquatic and terrestrial systems that compares ecosystem structure and process resulting from harvesting activities to inherent disturbances and subsequent renewal. The research should be continued and relevant results implemented.
- Knowledge about the inherent disturbance regime, such as wildfire, should be augmented so that a better understanding of its importance in the maintenance of ecological integrity is achieved. Surrogate approaches to replicate desired disturbance effects are needed for application in areas where the inherent disturbance regime must be changed.
- Since most forest stands originated as a result of fire, post-fire conditions and long-term successional patterns require study to gain insights into design of forest harvesting and silvicultural treatments. These are required to approximate, where appropriate, the effects of fire that most contribute to forest renewal and maintenance of biological diversity.
- Effective ways of monitoring ecological integrity, including the conservation of biodiversity, should be developed at a provincial level and applied.
- The science base of whole landscape management that maintains ecological integrity while allowing management for various human values (including social, economic and ecological values) needs further development.

2. Desired Future Forest

DEFINING A VISION OF A DESIRED FUTURE FOREST IN ALBERTA IS A NECESSARY STEP IN IMPLEMENTING A MORE SUSTAINABLE FOREST MANAGEMENT PROGRAM.

The characteristics of a desired future forest are determined through the identification of social, economic and ecological values to be sustained. The characteristics of a desired future forest are then forecast from the existing forest (including current commitments) and an understanding of the processes under which it has evolved. The forecast includes trends in human use and changes in other elements of disturbance such as wildfire and predicts outcomes in term of forest structure, composition, ecosystem flows and benefits. The forecast includes transition flows and states from the existing to the desired future forest.

The timber supply, other resource uses and values such as quality of land, air and water, are determined

within the context of the desired future forest.

Forest plans need to include an implementation section that clearly outlines the activities to be undertaken, their cost and the committed funding sources.

2.1 Rationale

A desired future forest represents a dynamic forecast selected from a range of possible outcomes. This process differs from the current practice of static zoning and prescriptive rules.

Forecasts allow for the determination of flows of benefits such as ecosystem services, timber, access, habitat, biodiversity and other values. These flows can be assessed on their economic, ecological and social impacts. Forecasts can test the sensitivity of benefit flows to various assumptions and constraints and assess the cumulative impact of multiple resource use.

A desired future forest forecast provides mechanisms to integrate various intensities of human use (including landscapes protected from certain types of use, lands used extensively, lands used intensively and lands used for facilities) with overall ecological integrity.

A future forest goal allows updating of the forecast as better data become available and social objectives change. The specification of a desired future forest allows for a better assessment of success or failure.

2.2 Implications

- In the selection of the desired future forest scenario, uses of the landbase such as oil and gas, parks, agriculture, aboriginal use and recreation would be factors. Local community representatives and the general public would be involved in the determination of the selection.
- The desired future forest defines timber supply and provides a basis for evaluation of the sustainability of forest values.
- Fundamental issues in planning of a future forest are:
  i) The values sought in the forest must be explicitly described and measured. Caution should be taken not to let this focus on measurement systematically exclude important values that are difficult to measure.
  ii) The values sought in the forest should be functionally related to forest characteristics. For example each value should be related to stand type, stage of stand development, and/or configuration within a landscape such as a watershed.
- A desired future forest would be feasible to attain biologically, economically and socially starting from the present. Public presentations must clearly present various future forest states, the costs and benefits of these states and the paths taken to get there.
- Provincial forecasting has not had explicit linkages to the local level. In the selection process, provincial forecasts need to be spatially explicit and, should allow for aggregation from local levels.
- The achievement of a desired future forest requires the integration of management principles and sustainability ideas from many disciplines but, in particular, from ecology and economics.
- Industry will be challenged to become more innovative in attaining forest objectives. As a result the provincial regulatory agency could then become less prescriptive.

2.3 Science Requirements

- Forecasts require specific quantitative assumptions about the development of individual forest inventory polygons (e.g. ecological processes, yield, risk of loss, stand structure, species composition etc...). Forecasting requires critical analysis and rigorous data collection.
- Timber management focuses on easily measured and well understood features of stand type, stage of stand development and geographic pattern. By extension, if timber management influences the availability of non-timber values such as recreation or carbon storage, those values are also related to type/ stage / pattern. As a result, an emphasis should be placed on the establishment of functional relationships between non-timber values and the pattern of types/stages in the forest.
- Emphasis needs to be placed on better forest characterization. This is the means by which the forest is described using attributes from which the state of forest values can be inferred and the effect of management actions can be expressed. To enable the manager to prescribe actions that result in a forest condition which provides the desired values of the owner, it is essential that the values be defined in terms of appropriate (and obtainable) forest characteristics *and* that effects of management actions be defined in terms of the *same* forest characteristics.
- The scientific basis and protocol for areas of intensive forest management, such as increasing wood yields, are required.
- The development of forest level models that recognize both temporal and spatial change are essential. These models must be designed to be used to readily inform the public.
- Population demographics (urban, rural, aboriginal etc...) along with changing consumptive demands need to be developed and incorporated into the forecast.
- The development of new and/or the modification of current computer simulation models for the Alberta forests are needed.
- Balancing the functional relationship between human values, their expression in quality and intensity of use and the maintenance of ecological integrity is the essence of defining the desired future forest and the transition required from the existing forest state and benefit flows. As an example, any enhancement of timber supply through more intensive forest management (public or private) must be balanced between demand for timber and the maintenance of ecological integrity. Balancing models and mechanisms require further definition.

3. Social and Economic Values and Public Involvement

SOCIAL AND ECONOMIC VALUES ARE INTEGRAL TO THE SELECTION AND ATTAINMENT OF THE DESIRED FUTURE FOREST.

Timber and non-timber values, activity levels and existing commitments of the landbase should be quantified and integrated into the projection of the future forest condition and flows using scientific methods to determine market and non-market conditions, trends and the evolution of these trends.

3.1 Rationale

Timber values, and the impact of alternative forest management approaches on these values, can be quantified using economic assessment methods. These methods summarize a form of public interest in forest management; interest reflected by participation in the market for forest products.

Some non-timber values, including some values of ecosystem services, are quantifiable using established scientific techniques and data collection methods that rely on structured public input. Other non-timber values are not easily quantified and are not easily integrated into quantitative assessments of landscape conditions. Public involvement should be the key component in identifying, analysing and weighing these non-timber values in context with quantifiable timber and non-timber values.

Since forest resources in Alberta are predominantly owned by the Crown in the right of Alberta, involvement of the public is needed to evaluate the benefits arising from these resources and in the setting of goals and objectives for the management of multiple benefits. Public involvement is a recognized component of Sustainable Forest Management as described by the Canadian Council of Forest Ministers, the Alberta Forest Conservation Strategy, and the principles set out by most of the major Forest Certification schemes worldwide. However, it should be recognized that there are several levels of "public" interest in forest management, ranging from interest by consumers of forest products worldwide, to members of the general public within the province who may or may not be users of the forest landbase, to members of local communities who are commonly users of the forest resource base and are interested in the environmental and economic impacts of forestry on local social and ecological conditions. Information from the various "scales" of the public is needed for a more complete view of public demands on forest lands, however, defining and eliciting information from these diverse groups is scientifically challenging.

Non-timber value assessments can be used to establish goals in the future forest evaluation process. In order to be effective, however, these non-timber valuation efforts must be conducted in a trade-off or compensatory analysis framework in order to reveal the relative merits of one future forest scenario over another. Furthermore, these approaches should make explicit any existing responsibilities, rights and commitments and the degree of latitude in these initial conditions so that the process focuses on problems with realistic scope and does not generate unrealistic expectations. Finally, input from the various scales of publics must be integrated and balanced.

3.2 Implications to Timber Supply and Other Factors

- The explicit incorporation of social and economic values into the definition of the future forest may have little effect on the timber supply in the short term because of existing commitments; however, over the medium term (5-20 years) other values may take precedence over timber values or enhance the value of timber.

- The integration of social and economic values, at various levels, will aid in the assessment of timber supply levels. Timber supply and associated economic returns are only some of the benefits generated by the forest.

3.3 Scientific Base Required

- At a global level, human values and choice can be viewed as the marketplace or economic consequence of alternative decisions by consumers and firms. Improved knowledge is needed of the market opportunities for sale of products, including trends in the demand, supply and product substitution, as well as the linkage between environmental performance and market access via certification. The market for products is seldom viewed as public involvement, yet it is one of the most clearly defined forms of public participation in forest resource use decisions. Furthermore, if

certification schemes operate effectively, the market will provide individuals worldwide with the opportunity to express their preferences for environmental aspects of the products as well as the material aspects.

- At the federal, provincial and local level the legitimacy of the democratic process of governance must be recognized as an important element of the valuation and public involvement process.
- Public involvement is a critical element for the collection of information on non-timber values, particularly those related to activities in the forest and to ecosystem services. Additional science is required to further integrate non-timber activity levels with forest or ecosystem service flows and to improve the predictive nature of the models of these activities. A significant gap in this area of study is the inventory of activities and uses in a spatial and temporal context. Improvement of this inventory will require additional efforts in survey research, often in a variety of cultural contexts aimed at different components of the public, to capture the fundamental elements of non-timber related activities. This is critical in the case of northern residents of Alberta, eg. Aboriginal peoples.
- The assessment of the preferences of the public for alternative future forest conditions and value flows, - scenario analysis- must be reached through public participation. For the broader public, assessment of preferences can be based on science techniques for preference elicitation (e.g. Mitchell and Carson, 1989; Keeney and Raiffa,1976) within a realistic framework of current resource use and ecological integrity. At the local level similar techniques can be employed. An alternative approach relies on the use of group discussion conflict resolution techniques (e.g. Von winterfeldt and Edwards, 1986; McDaniels, 1996). Public involvement should be designed to be inclusive, transparent in terms of its role in decision making, have the potential for revisiting the issue on a formalized time scale (e.g. every 5 years), be oriented towards achieving public objectives rather than satisfying consistent demands, be integrated with public education to increase understanding, awareness and trust levels between all parties involved, and be flexible within the cultural context (Murphy, 1996; Leiss and Chociolko 1994).
- The use of future forest scenarios forms a solid basis for the assessment of social and economic value through public involvement. This approach provides a scientific assessment of the implications of the alternative scenarios. Such an approach also serves as an education mechanism and provides public feedback on the scientific assessments. However, efforts should be made to separate values from technical aspects and recognize values when they are presented as part of the future forest scenario.
- Adaptive management is associated with ecological management (AFCS 1997). It should be employed in social systems as well. New public involvement approaches, or development of new social institutions for the allocation of resources, could be tested on a regional basis and can become an explicit part of resource management designed to investigate the efficacy of new mechanisms.

4. Scales-Spatial and Temporal

THE TEMPORAL AND SPATIAL SCALES USED TO MANAGE THE FOREST MUST BE CONSISTENT WITH THE SCALES OF DISTURBANCES AND PROCESSES INHERENT TO THE FOREST AND SOCIAL SCALES RELEVANT TO FOREST RESOURCE USE.

4.1 Rationale

Ecological processes occur on several spatial and temporal scales. In the boreal forest, processes may occur on spatial scales from 1 cm (e.g. photosynthesis within a leaf) to hundreds of km (e.g.

large fires on landscapes). Temporal scales may vary from months (e.g. seasonal changes in weather) to thousands of years (e.g. geological processes) (Holling 1992). Elements of biodiversity (composition, structure and function) can also be organized in a hierarchy of scales: genetic, population/species, community/ecosystem, and regional/landscape (Noss 1990). Ecological organization at the highest levels has unique properties that cannot be explained by simply "scaling up" processes at lower scales (Allen and Starr 1982).

In planning the future forest, relevant spatial scales will be multiple and might include within-stand habitats (~1-100m^2), stands or non-forested units (e.g. peatlands) (~10-100ha), landscape units (>10,000ha), and forest regions (e.g. boreal mixedwood forest). Landscape units follow ecological boundaries and contain major ecological flows and elements of interactions and will likely be different for aquatic and terrestrial systems (e.g. watershed, landform, fire regime). Within-stand habitats are unique or localized habitats which support unique or rare species. Stand management may include retaining trees to provide structure and downed woody material. Landscape management would approximate inherent patterns of stand sizes, amount of edge, juxtaposition of different stand types, landscape connectedness and other landscape metrics. Landscape management would include the total forest landscape including protected areas.

Temporal scales used in planning the future forest landscape should mesh ecologically relevant scales (seasonal and disturbance intervals e.g. wildfire, floods) with those meaningful for human planning. They may span 1-5 yr for short-term planning up to 3-4 fire return intervals for longer term planning. Seasonal planning would include scheduling potentially disruptive activities in the forest to periods with the lowest impact. Longer term planning would include variation in rotation ages of stands to approximate inherent age class patterns and to account for different successional patterns with site type. Deterministic models must incorporate output that includes stochasticity of events (flood, fire) so that risk can be incorporated into planning.

Social processes such as public involvement also occur at several scales. At the global scale, markets for forest products influence the demand for forest products. Shifts in global markets will have significant impacts on resource requirements and the economic viability of operations in Alberta. These global level effects will in turn affect national, provincial and local levels economically. Conversely, changes made at the local level may, through international trade linkages, have global repercussions (Sedjo, 1995). A second social scale is the people of Alberta. Alberta's citizens, while not all users of forest lands directly, have preferences for broad strategic objectives of forest resource use such as more recreational use or more specific values such as biodiversity, wildlife conservation, economic diversity and other aspects of forest ecosystem services and products. Direct users of the forest, including local communities and Aboriginal groups, form another social scale where concerns may be for local interests, including economic development, as well as for the broader strategic objectives. Effective forest resource management will employ information from all of these scales as well as the linkages between these scales.

Related to the various social scales are the temporal dimensions associated with social values. Demographic trends, technological change and continuing human development will generate changing demands for forest ecosystem services and forest products. Evidence suggests that in the developed world, the value of non-timber goods and services will increase, partly due to the relative scarcity of these goods and partly due to changing preferences of individuals in society. Furthermore,

time scales for industrial aspects of forest product production, associated with international capital markets and global competition, are substantially different than those for ecosystems.

4.2 Implications

- Through an understanding of the spatial and temporal scales of natural systems dynamics, conservation of biodiversity will be realized more readily.
- Through an understanding of spatial and temporal scales, the public will better understand the basis for a sustainable forest.
- At the provincial scale, management will cross tenure boundaries, and should involve coordination and cooperation of the government, citizens of Alberta, FMA and quota holders, woodlot owners and other users of the forest.
- The province should facilitate planning and management at the landscape unit and larger spatial scales, provide for integration at the provincial level.
- Models for forest values must be spatially and temporally explicit and multiscale.
- Impacts of resource users should be considered at relevant scales and be integrated with forest management.
- The cumulative effects of management decisions, land use and inherent disturbance over space and time need to be addressed.
- Trends and time scales, as well as continued scientific efforts to forecast and understand trends are required for accurate depiction of the future forest condition and the path towards this future forest.

4.3 Science Base Required

- Planning tools, such as spatially explicit resource supply and landscape models, must be developed for large-scale (landscape and above) management.
- The scientific basis for ecologically and socially relevant landscape units for planning (e.g. define fire patterns, watersheds, boundaries of ecological flows) and for tenure should be established.
- The impact on users (forestry, oil and gas, parks and others) of any change to management units should be assessed.
- Not all variables can be aggregated from the small to the large scale. Research and guidelines must be developed to determine which variables can be scaled up or down and what transformations are necessary.

5. Adaptive Management

ADAPTIVE MANAGEMENT MONITORS PROGRESS TOWARDS THE DESIRED FUTURE FOREST, CONTINUALLY IMPROVES THE KNOWLEDGE BASE AND ADJUSTS ACTIONS TO CORRECT FOR DEVIATIONS

Adaptive management is a process of hypothesis testing at the scale of whole systems. It continually evaluates and adjusts management relative to predicted responses, objectives and predetermined thresholds of acceptable change.

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Adaptive management includes improvement of the data and analyses on which forest management predictions are based, and testing of the assumptions underlying the management practices carried out on forest lands.

5.1 Rationale

The process of implementing a land management plan is fraught with unknowns, stemming both from our imperfect knowledge and from the inherent unpredictability of nature. Although the best available information may be used to predict responses, many uncertainties remain. The unknowns will be greatest where management includes new or seldom-applied management options in response to a broader array of social and ecological objectives. Furthermore, treatments that were found workable within the controlled environment of experimental plots may require testing in operational settings. Adaptive management requires that scientists and managers in collaboration, establish a framework for scientific testing of the concepts, methods, and assumptions applied to the land.

The adaptive management framework has two components. First, there is the need to design and apply specific prescriptions as experiments, including suitable controls and replications. The design of these experiments is adjusted on the basis of the ongoing analysis of results. These experiments may include extreme applications of a proposed approach - similar to the concept of "testing to failure" used by engineers. In other words, to learn rapidly we may need to try the extreme versions of management practices that we conjecture are "correct".

The second component of adaptive management addresses the cumulative effects of management in space and time. These are evaluations of whether the system overall is responding as predicted, and whether the management appears to be on a path leading to the desired outcomes specified in the plan. In other words, adaptive management includes ongoing evaluation of whether the various actions and practices that are applied to the land appear to be "adding up" to the desired future conditions and outcomes. Key elements in these evaluations include monitoring of selected indicators, identification of ranges of variation and/or thresholds for those indicators, and feedback mechanisms for adjusting the assumptions, models, or management practices that account for the deviations. For example, a key question in ecosystem-based management is whether habitat and other habitat elements will "add up" to landscape conditions capable of maintaining biological diversity. Monitoring individual treatments will not answer this whole-system question. Instead, indicators will be required to evaluate the cumulative effects of these treatment strategies in space and time.

Adaptive management requires the establishment of reference areas to allow interpretation of research and monitoring results. The functions of these reference areas are twofold:

1. Reference areas are required as spatial controls for the experiments carried out in adaptive management. This requires reference areas that are representative of the experimental area in terms of stand age classes, species composition of plants and animals, and spatial layout and size of stands.

2. Another function of reference areas is to measure background change that is occurring regionally or globally; for example, changes in air quality or plant and animal populations that may be associated with global atmospheric or temperature conditions. In adaptive management, the purpose of

monitoring is to measure change and effects that result from the management under evaluation. It is essential to be able to distinguish the effects associated with management from background change that emanates from other sources.

5.2 Implications

- All projections of forest management outcomes, including timber supply, are tentative.
- Managers must acknowledge the limitations of our understanding of forest ecosystems, and strive to reduce uncertainty through monitoring and research.
- Adaptive management and large-scale research require close collaboration of scientists and managers.
- The cost of monitoring and research must be accepted as an integral cost of the business of forest management.
- There must be feedback mechanisms that link the results of monitoring and research to the forest policy arena (Lee 1993).
- Adaptive management will require greater flexibility in our social systems.

5.3 Science Requirements

- Changing the focus from individual uses to a system perspective requires an interdisciplinary research environment that encourages interaction and cooperation of scientists from diverse disciplines and areas of specialization.
- Knowledge to support forest management must derive from two kinds of science: the science of parts, emerging from traditions of reductionism; and science of the integration of parts, which derives from a whole-system perspective (Walters and Holling 1990).
- Alternative statistical approaches suited for large-scale experiments, both deliberate and unplanned (i.e. retrospective studies), need to be applied in adaptive forest management (see, for example, Likens 1985, Schindler 1987, and Carpenter et al. 1989).
- Evaluating how ecosystems and associated values and properties (such as biological diversity and resilience) may respond to the collective, cumulative, and long-term effects of management requires scientific examination at multiple (including large) scales, and from a whole-system perspective.
- The scientific basis and protocol for the establishment of reference areas to assess sustainable forest management is required.

C. CONCLUSION

Achievement of Sustainable Forest Management is a complex process, but may be approached more systematically by considering the five elements that have been described here: Ecological Integrity and Inherent Disturbance, Desired Future Forest, Social and Economic Values and Public Involvement, Scales - Spatial and Temporal, and Adaptive Management. While these are consistent with the definition of Sustainable Forest Management, they are qualitatively different from any other timber supply protocol in Canada.

The Council's definition of Sustainable Forest Management is consistent with but not the same as the definitions of the Canadian Council of Forest Ministers or the Alberta Forest Conservation Strategy. The

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Council has changed the definition so that a clear connection between ecological integrity and social and economic values can be made. **The Council advises the Land and Forest Service to raise this difference to the Minister of Environmental Protection and the Minister of Natural Resources Canada to ensure that this protocol is consistent with Alberta's and Canada's approach to Sustainable Forest Management nationally and internationally.**

It is not clear to the Council that the scope of what is proposed in this document is feasible to undertake. Particularly in the area of non-timber values and their linkage to forest characteristics at various scales, the costs and benefits need to be determined and applied through a pilot process. Another important feasibility issue is "testing the system to failure" as proposed in the Adaptive Management element. Also, the criteria for reference areas needs to be clarified.

Finally, a trade-off analysis framework (Section 3) as between timber and non-timber values needs to be developed and tested in a public format.

This work has been undertaken by the Council over the last year. We have discussed sustainable forest management with some of Alberta's leading forest companies as well as other provincial government. The Council met with Dr. Jack Ward Thomas, former Chief of the U.S. Forest Service and has had the document reviewed by the following people: Bob Andrews, Director, Wildlife Alberta Environmental Protection; Dr. Gordon Baskerville, Professor of Forestry, UBC; Dr. Tom Beckley, Canadian Forest Service; Ms. Lea Bill, Community Health, Sisksika Nation; Dr. Clark Binkley, Dean of Forestry, UBC; Dr. Bill Fuller, Professor Emeritus, UofA; Dr. Daryll Hebert; Alberta Pacific Industries; Mr. George Weyerhaeuser, Mr. Bruce MacMillan, Dr. Luigi Morgantini, Weyerhaeuser Canada; Mr. David Neave, Executive Director, Wildlife Habitat Canada; Dr. Brad Stelfox, Forem Consulting; Dr. Jack Ward Thomas, Boone & Crockett Wildlife Professor; Dr. Terry Veeman, Professor Rural Economy, UofA.

In the view of the Council, this protocol, should it prove feasible, will provide the province of Alberta with a science-based timber supply protocol that is consistent with sustainable forest management.

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Appendix 4: Challenges for the Implementation of Sustainable Forest Management

Alberta Forest Management Science Council

C.R.James (Chairman), V. Adamowicz, S.Hannon, W.Kessler, P.Murphy, E. Prepas, J.Snyder, G.Weetman, M.A.Wilson

Challenges for the Implementation of Sustainable Forest Management

Following the Council's work on:

- Timber Supply Protocols for sustainable forest management and
- the development of a model for a desired future forest for Alberta,

the Alberta Forest Management Science Council recommends that the Province of Alberta:

1) Ensure that land management proposals for further development, including forestry, petroleum, mineral, agricultural resources or other resources in the Green Area, include all users and assess potential cumulative effects.

2) Develop models, such as a desired future forest, that facilitate understanding of landscape dynamics and that display the management possibilities for:
   a) human use of forest resources and
   b) community preference for management alternatives and implementation in Alberta's Forest Legacy.

3) Use economic models that incorporate a broad spectrum of impacts and benefits for assessment of integrated management proposals for forested landscapes.

4) Proceed with management plans for forested landscapes that include:

   a) A common set of biodiversity objectives and indicators that reflect genetic, species and ecosystem levels of biodiversity . These should include indicators of ecosystem composition, structure and function.

   b) An explicit model and management system to ensure that ecosystem integrity is not impaired (e.g. natural disturbance model or ecological threshold model).

   c) A clear assessment of the need for and deployment of a system of representative protected areas; including reference areas for adaptive management.

   d) A plan for dealing with natural and economic stochasticity in terms of resource flow and state variables such as timber supply or biodiversity.

   e) A reassessment of aspects of tenure including embedded quota holder and FMA boundaries to ensure landscape units are managed at appropriate spatial and temporal scales.

5) Manage the forests of the Boreal Plain to maintain current mixed species composition.

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6) Entrench public involvement (including large scale sampling) in design of future landscapes.

7) Ensure involvement of aboriginal communities in social and economic planning of Alberta's Forest Legacy.

8) Develop strategies to encourage industry, university and government partnerships for forest research as a basis which attract and maintain leading world expertise in the province (university, public and private sectors).

9) Enhance continuing education of forestry practioners. Discipline of forestry should continue to encompass broader range of environmental fields brought together to solve problems.

10) Develop a new landscape management program that is able to apply and improve upon the concept of a desired future forest based on credible science. The program will have the capability to network with leading edge scientists from around the world, to commission research and to review and recommend change to Alberta's landscape managers in planning and operations.

Appendix 5: A Desired Future Forest for Alberta; A Model

A Desired Future Forest For Alberta; A Model

Proposed by The Alberta Forest Management Science Council

To
The Department of Environment
For consideration in Forest Management

Sometimes when the truck ride is bumpy, it helps to look far down the road.

Joan Snyder

With a trial and error (heuristic) search the manager arrives at a set of actions by forecasting and reviewing a relatively small number of possible futures. Each successive simulation is based on the manager's review of previous simulations. This process is *heuristic* because the manager learns about both the system responses and about what constitutes good goals as an integral part of the search process.

Gordon Baskerville

Management of land or forest systems arose from a need to ensure supply of goods and services - to reduce the uncertainty of supply inherent in the hunter-gatherer societies. Reducing uncertainty remains a fundamental, although not usually stated, tenet of management plans. The approach is usually implied by setting production targets or description of conditions, for example crop yields on agricultural lands, wood volumes on forest lands, or "natural " conditions on park lands. What we need to do now is to set more explicit targets and for a greater range of values.

Peter Murphy

June 99

C.R.James (Chairman), V. Adamowicz, S.Hannon, W.Kessler, P.Murphy, E. Prepas, J.Snyder, G.Weetman, M.A.Wilson

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Alberta Forest Management Science Council

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Introduction

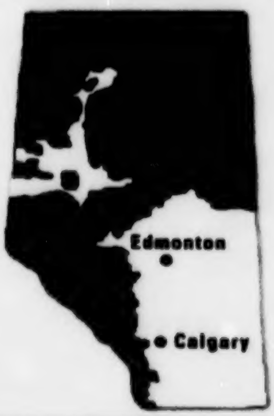
The Alberta Forest Management Science Council completed a Timber Supply Protocol for Sustainable Forest Management in September 1997. The Protocol includes five elements:

1. Ecological Integrity and Inherent Disturbance
2. A Vision of a Desired Future Forest
3. Social and Economic Values and Public Involvement
4. Scales in Time and Space
5. Adaptive Management.

In the Protocol, the Council recognised that "uncertainty exists in terms of the science base of ecological integrity as well as social and economic values. Uncertainty also exists in their forecast. The Protocol provides a framework under which uncertainty can be incorporated into forest management"[1]. At the heart of the protocol is the development of a compelling desired future forest and the increased understanding gained in striving for its attainment through adaptive management.

Following a round of presentations by Council members at a meeting of the Rocky Mountain Section of the Canadian Institute of Forestry (January, 1998), the Alberta Forest Management Science Council (AFMSC) was requested to provide guidance in the development of a desired future forest.

Alberta's Forests



Alberta's forest lands account for 54% of the province's land base. Of that land base approximately 2/5s are suitable for commercial forest use (Alberta Environmental Protection, 1996).

The Province has managed its commercial forest use through a system of Quotas and Forest Management Agreements. Quotas are a volume-based tenure with volume allocations at the discretion of the Crown.

The Province has promoted the development of forest management agreements since 1954. Forest management

[1] Alberta Forest Management Science Council, 1997. A Timber Supply Protocol for Sustainable Forest Management in Alberta.

agreements are area-based tenures that require the development of facilities, long-term forest plans and forest regeneration programs from companies in exchange for timber rights. The Province retains the right to approve forest management plans on an agreed upon schedule laid out in the Forest Management Agreement.

The forest land base is also extensively used for a wide variety of other values. Energy use, in particular, has been a major player in vegetation modification and changes in use patterns in the Green Area.

It is clear that, as the Province is further developed, some guidance for development is required and that the desired future forest concept should address all uses, not just timber supply.

Figure 1 illustrates forest change in Alberta. The view is taken in a well-known forest in Alberta near Castle Mountain in Banff National Park. It illustrates regeneration of Lodgepole Pine after logging. Some of the original stumps are still visible after 90 years.

Figure 1: Comparison of a view from Castle Junction 90 years ago and today. The picture in the top left taken in 1904 (P. Murphy, pers. Com.) - it is provided courtesy of the Glenbow Alberta Archives. The ones on the bottom left and the top right were taken in 1995. The figure illustrates two key forces in Alberta's forests: disturbance and regeneration.

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The Purpose of this Document

In this document, the Council provides basic definitions and key steps to the development of a desired future forest and an example for consideration by the Department of Environmental Protection. The document should be used as a model on which to base the derivation of a more complete definition of a desired future forest. In the view of the Council, it is important to start with the "end in mind" - a clearly defined future outcome that is compelling to Albertans.

The document is divided into three parts:

1) Basic Definitions and Key Steps
2) A Model of a Desired Future Forest.
3) A Summary of Some Costs and Benefits.

Basic Definitions and Key Steps

What is a Desired Future Forest?

The Desired Future Forest (DFF) is a spatially explicit projected range of conditions of the forest landscape 100+ years into the future. The range of forest conditions defines the goal towards which forest management will be directed. It is our best guess today on the arrangement of forest age classes, roads and habitats that will provide for a set of objectives and desired outcomes that have been identified for the area.

A DFF is contained within defined *boundary and initial conditions* including social, economic and ecological forces that affect the forest and its future. Boundary conditions are spatial in nature; initial conditions are temporal.

A DFF is chosen between alternatives and is often a combination of alternatives based on publicly acceptable tradeoffs between uses.

A DFF is about making informed choices about the use of resources where the management direction is defined with the public. In some cases wise choices about the use of resources will be to establish a wilderness area or a benchmark area. In other cases this may involve forest harvesting.

Boundary Conditions

Boundary conditions have been used in many sciences to establish the area of investigation. In the context of a desired future forest three critical dimensions including ecology, economy and society must be considered. Some examples are given below:

- Ecological boundary conditions are generally defined by ecological states[2] - e.g. Forest type, watershed characteristics - that are relevant to the area of interest. Care should be taken to insure that the boundary condition is chosen with regard to these states.
- Social boundary conditions are also spatial in nature, identifying key communities in and proximate to the area.
- Economic boundary conditions include elements like manufacturing facilities or recreational users currently using resource flows from the area.

Initial Conditions

Initial conditions specify key variables in a temporal context. Generally, these variables define the key states, stocks and flows at their current value. For example:

- Ecological initial conditions might include the current biodiversity of the area, the current disturbance sources and their probability of occurrence.
- Social initial conditions might include current demographic information of forest users and their preferences.
- Economic initial conditions might include the current resource base of the area and its current value.

Ecological Integrity and Inherent Disturbance

A DFF should maintain ecological integrity by:

- sustaining ecological processes -such as nutrient recycling, hydrological cycling, renewal processes, or predator-prey dynamics to a level that ecological resilience is not impaired.
- conserving plant and animal communities and by not causing the extirpation of species from the planning area.

---

[2] A forest ecosystem can be described in terms of its states, stocks and flows(Brooks and Grant, 1992).

- A *state* describes the condition with respect to certain observable attributes measured at a given moment. Key state attributes include age, structure and composition of vegetation; type,, magnitude and distribution of wildlife; and type, magnitude and distribution of human benefits. States such as "Old Growth" can be identified by condition and consequent process.
- A given state supports various stocks and flows:
  - *Stocks* are quantities of resources per unit area (e.g. Number or volume of standing trees, density of spotted owls or pine martens, miles of trail).
  - *Flows* are the periodic yields from the stock of the system (water or sediment discharge, annual production of fibre, annual smolt escapement, and forest-dependent jobs). Stocks can be viewed as the natural capital of the system(Costanza *et al.*, 1991)

The maintenance of ecological integrity establishes the range of possibility within which resource uses and production levels may be considered.

Ecosystems change state over time in response to both succession and disturbance forces; disturbance includes human management as well as natural events such as fire, disease and insects. Factors that develop slowly, such as atmospheric pollution and climate change are less obviously disturbances but are likely to affect both succession and disturbance processes.

Social and Economic Values

The description of a desired future forest must also include a translation of ecological or biological conditions into social and economic outcomes. A particular forest structure will support a certain level of forest harvest (which can be translated into timber values and local community impacts). This forest structure and the corresponding flow of wildlife ad other non-timber resources will also support recreational activities, subsistence uses, etc. These can be translated into economic outcomes.

Scales - Spatial and Temporal

Not all values/ objectives will be met for each forest unit on the landscape, but the cumulative effects of all DFF's across the landscape must maintain ecological integrity. Higher-level planning at the provincial level is required to ensure that ecological integrity is maintained throughout the province.

Adaptive Management

The steps of adaptive management must clearly be defined including the transition from contemporary management to management for the desired future forest. All of the monitoring and evaluation work needed for the forest manager to learn about the system in terms of its responses and feasible goals should be specified.

Why is a Desired Future Forest needed?

Management by Design

The desired future forest provides a target goal for management actions of protection, harvest rate, timing and location, and silvicultural regeneration and tending. Management actions are designed and strategically planned to attempt to achieve a target landscape condition.

The DFF quantifies the implications of various land-use scenarios (including the cumulative effects of use) for the stocks, states and flows of the forest. It allows for management of the forest as a single unit, instead of a piece-meal approach that manages each

industrial and recreational use independently. This feature of the desired future forest is consistent with Integrated Resource Management in Alberta.

It allows for informed decisions to be made with respect to potential trade-offs between values by facilitating interpretation of visual and quantitative assessments of future landscape perspectives.

Management by Default

Contemporary forest management that segments use into different landscapes may lead to a future forest that is at odds with its society's desires.

The absence of a Desired Future Forest (DFF) may lead, by default, to loss of genetic or species-level biodiversity and ecosystem structure because they are not explicitly considered in time and space. Such losses have occurred in other jurisdictions.

Lack of a desired future forest may also lead to a loss of economic opportunity since relevant human values are excluded from analysis.

How a Desired Future Forest is developed and chosen

Introduction

Developing and choosing the DFF has 5 main stages:
- Establishing co-operation
- Constructing an objective, spatial, temporal forest simulation model that forecasts what might happen under different conditions.
- Developing feasible resource objectives and management scenarios
- Determining the desired future forest amidst alternatives.
- Maintaining co-operation by taking joint steps to the desired future forest.

The 1st stage: Establishing Co-operation

1) Form a group of users and potential users to direct the development of the desired future forest. The group should pay particular attention to establishing trust in each other as a prerequisite to co-operation. Care should be taken to represent the breadth of existing users as well as potential uses.

2) Conduct an initial scoping session to solicit people's views, concerns and preferences with respect to the future of the area. Organise this information into a set of themes that you can then explore during scenario planning.

The 2nd stage: Construction of a Forest Simulation Model

1) Work with various groups of scientists (ecologists, economists, etc.) to develop the best predictive models of ecological, social and economic phenomena. These would include predictions of exogenous factors (population, climate for example) as well as endogenous elements (e.g. timber harvest as a function of growth rates and disturbance).
2) The model should include:
   - economic, social and ecological values tied to forest structure and composition.
   - forest dynamics (forest succession, natural disturbances (fires, insect outbreaks)).
   - potential changes in use as affected by biophysical, economic, social and technological trends, which will change over time.
   - a range of outcomes that are likely to occur because of stochastic events or uncertainties in our knowledge. This relates to the uncertainty in predicting ecological as well as economic processes.
   - explicit statements of ecological and economic relationships and test the sensitivity of assumptions and relationships in the model. In building the models, we will find gaps and weaknesses in our databases and point the way to further research.

The 3rd Stage: Developing feasible resource objectives and management scenarios

1) Organise the views, concerns and preferences of the initial scoping session into a set of themes that can be explored during scenario planning. For example, the following five themes could be explored:
   - maximise the number of jobs in the forestry sector and maximise long-term economic benefits of use of forest products
   - retain current wildlife species and restore endangered and threatened species above minimum viable population size.
   - reduce the probability of large-scale wildfire to level x.
   - develop ecotourism to level y.
   - retain aboriginal values related to the forest.

   Scenarios such as "Wildfire disturbance" or "business as usual" are base case scenarios defined by initial and boundary conditions. They can illustrate the practicality of the existing resource commitments for the production of the desired future forest but do little to explore the potentials of the area .
2) Run the scenarios of the themes through a heuristic computer model. You must specify the conditions both within the forest and within the forest-based economy consistent with each theme goal. The suite of human values for a given forest should be described

in terms of the stock and flow of those values currently and under the desired future forest condition.

3) Each theme that is run through a simulation program must have spatially explicit outputs that can be examined by all the participants in the planning exercise.
4) Assess HOW EACH THEME SCENARIO AFFECTS OTHER SCENARIOS. This allows interpretation of benefits, consequences, and trade-offs. Use a computer program that shows the resulting forest landscape for each theme in three dimensions. This allows the participants to "fly over" the future landscape and assess what these changes might be.
5) More explicit relationships relating forest conditions to key wildlife or ecological integrity indices are mapped and economic indicators produced.
6) Variables, such as recreational or tourist use, should be modelled using a behavioural model that takes into account factors within the DFF region (e.g. number of tourist facilities) and factors at a larger scale such as overall human population growth and demographic change.

The 4th Stage: Determining the desired future forest

The planning process continues with the "fine-tuning" of the model until a future landscape is depicted that is acceptable to participants, is realistic and doable and which clearly shows the tradeoffs between the themes.

It is important in this stage, that the decision about the desired future forest is taken by people trusted within their communities and as representative as possible of user interests.

A decision process must be developed that takes into account the costs and benefits (economically, ecologically, and socially) of the various scenarios. This is done by:

a) Systematically administering a set of preference assessment methods (in the literature these are referred as multi-attribute utility measurement methods or experimental analysis of choice methods) using the scenarios and their elements to construct the experimental design. These methods rely on each individual presenting their choices, but benefiting from the group discussion and interaction on the scenarios.
b) Returning to the group with the results describing their preferences, illustrating where divergences occur, which attributes are important to them and re-evaluating their responses.
c) After iteration with the group, presenting a scenario that best reflects their desired future forest, or attempting to construct a new scenario that reflects their interests.
d) Agreeing to re-evaluate the process and the desired future forest at some time in the future (5 years) This will include an assessment of how well the predictive

models are functioning and how well the path toward the desired future forest has been followed.

In this process the agreement on the use of the "results" is essential and building of relationships and trust between the users is critical. This is not a short, one time, public meeting. The research in social psychology shows that often the "process" is at least as important as the outcome. Parties may enter being interested in a specific outcome (e.g. a protected area) but may adhere to the process and become less interested in a specific outcome as the process progresses. A second significant area is the make-up of the group. Some groups may not wish to be included in such a process. A separate process may need to be developed with a bridge to the main function.

The 5th Stage: Adaptive Management

- The final DFF must also include a process of how to manage the forest in the face of uncertainty and stochasticity. It must be flexible enough to modify as knowledge about ecological, economic and social processes and prediction improves. Careful incorporation of things like technical change (e.g. labour saving technology in the pulp sector) is a necessity.
- Currently, forestry models "grow the forest" using yield curves for each inventory polygon. To date, we do not have realistic "process based" ecological models to apply to forested landscapes. Hence, we must determine, through research, the range of variation in ecological processes and what the "thresholds" are in ecological processes, beyond which ecological integrity is impaired. An integral component of the process of achieving the DFF is adaptive management. We can't just build the models, make our scenarios, pick one and then sit back. Adaptive management allows us to continually evaluate our progress towards the DFF and to change our course if necessary. (See AFMSC document "Sustainable Forest Management and its Major Elements" for a detailed discussion of adaptive management)
- Important to the adaptive management process is the establishment of reference areas to allow interpretation of research and monitoring results. The functions of these reference are twofold:
  - As spatial controls for the experiments carried out in adaptive management. This requires reference areas that are representative of the experimental area in terms of stand age classes, species composition of plants and animals, and spatial layout and size of stands.
  - To measure background change that is occurring regionally or globally; for example, changes in air quality or plant and animal populations that may be associated with global atmospheric or temperature conditions. In adaptive management, the purpose of monitoring is to measure change and the effects of management. It is essential to be able to distinguish the effects associated with management from background change that emanates from other sources.

What should a Desired Future Forest document look like?

The Desired Future Forest document should be short, clear, compelling and spatially and temporally explicit. It should include:

A Desired Future Forest Description

The document should contain a description of forest states, flows and stock variance of the desired future forest and their social and economic implications including a visual representation of the landscape.

Boundary and Initial Conditions

A clear definition of critical ecological, social, economic boundary and initial conditions.

Steps to Attain the Desired Future Forest

The documents should include a one-page summary of the steps required to attain the desired future forest and the experimental design required to assess its attainment. Each step should be written simply and clearly with lead actors identified, public costs quantified over the time required to attain the desired future forest and performance indicators specified.

Cost/Benefit Summary

Clear accounting for the costs and benefits of attaining the desired future forest and a consideration of alternative desired future forest under feasible scenarios.

A Companion Document

The companion document should focus on the process and content of the desired future forest so that the process can be repeated. Some examples of what the document would contain are given in Appendix I.

C.R.James (Chairman), V. Adamowicz, S.Hannon, W.Kessler, P.Murphy, E. Prepas, J.Snyder, G.Westman, M.A.Wilson

A Desired Future Forest: What it might look like

Introduction

Although the concept of a desired future forest has been tried in a number of instances, none have developed the concept in the way that we envision it.

The Council has selected the M^cGregor Model Forest, in British Columbia, as a template for consideration by the Province. The template is sufficient to illustrate the concept but does not apply specifically to Alberta.

For example,

- the M^cGregor Forest has a much different forest dynamic that Alberta. Old growth (over 141 years old) currently occupies almost 50% of the model forest. In Alberta less than 6% of old growth exists (Alberta Timber Supply, 1996) because of Alberta's past wildfire disturbance regime.
- Alberta manages its forests through forest management plans and groundrules adjusted to specific forest landscapes unlike British Columbia where the Forest Practices Code has been recently introduced and applied uniformly to the Province.

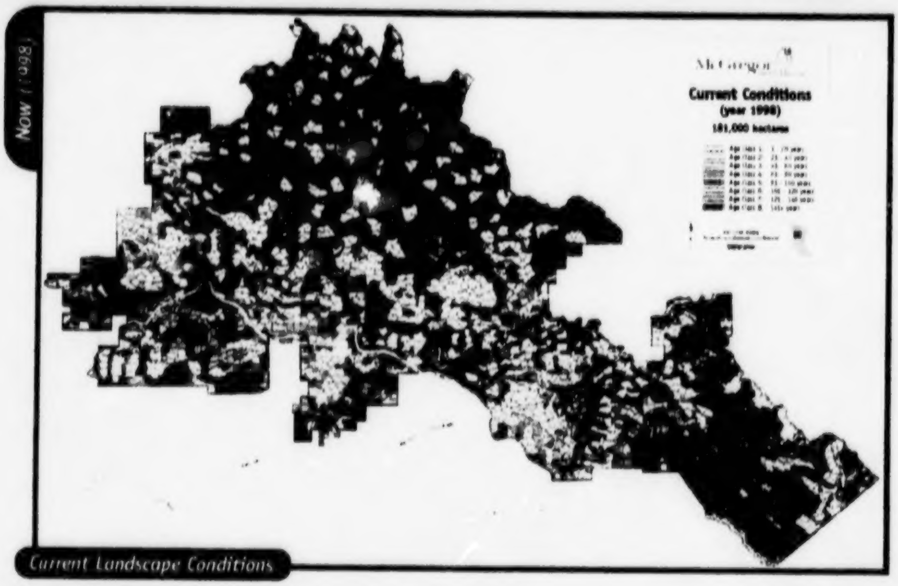
The example below provides two alternatives that are feasible given the initial conditions of the Model Forest but does not adequately translate key values into social and economic terms. It doesn't yet provide a spatial representation of key transitional steps to the desired future forest.

An Example: The M^cGregor Model Forest

Desired Future Forests...

Pursuing sustainable forest management by defining a desired future condition and designing management strategies to achieve it.

McGregor model forest



Current Landscape Conditions

The McGregor Model Forest Association is developing a sustainable forest management system to improve forest planning and management. Scenario planning is the first part of the system... It's a process through which different forest interests consensually explore what alternative forest landscapes are both desirable and possible. Advanced strategic & operational computer models that forecast measurable indicators determined through scenario planning are then used to portray the scenarios, the associated implications of each on various resource values, and the resulting landscape patterns. The models help determine which "management paths" (the distribution, scheduling and manner of operational harvest/silviculture activities) may best lead towards a desired future condition.

The McGregor's main study area *(shown above)* is located 30 km northeast of Prince George, BC, and is also known as Northwood Inc's Tree Farm Licence 30. While industrial forestry is the predominant land use, other more diverse forest values are increasingly represented in the area. Forest planning and management requires new ways to encompass such values (such as biodiversity and recreation) alongside timber activities, and this is the principle behind the McGregor's program of work. The scenarios shown here, while hypothetical, are realistic depictions of possible conditions under two alternative management strategies. The McGregor's system allows planners and managers to better work with community interests to design future forest landscapes that are both desirable and plausible.

The "status quo" management scenario *(#1 - top of page 2)* shows a desired future condition that adheres to the current regulatory objectives of BC's Forest Practices Code while maximizing the future sustained yield of timber. Visual quality objectives (VQO), forest ecological networks (FEN), riparian management, seral stage distribution based on biogeoclimatic units, 60 hectare maximum cutblock size, and 3m greenup & adjacency objectives are some of the Code's requirements. Caribou habitat zones & corridors, recreation areas and other exclusions are also encompassed. This "default" management approach has the effect of fragmenting and roading the landscape to a high degree, with many implications for other values and objectives. The yearly timber flow averages about 300,000 m^3.

An "alternative" management scenario *(#2 - bottom of page 2)* shows a desired condition that emphasizes biodiversity (as represented through seral stage targets) in conjunction with a maximized sustained timber yield. Since the desired condition is not simply regulatory compliance, this scenario excludes VQO, FEN or 3m greenup & adjacency objectives and employs variable cutblock sizes ranging from 40 to 500 hectares in size. Riparian management and other exclusion zones (caribou habitat, recreation areas) are still encompassed, however. The reduced "competition" between objectives and the greater blocking flexibility results in a less fragmented and less roaded landscape than the "status quo". This "designed" management approach may help achieve biodiversity objectives, but has resultant tradeoffs against visual quality and other objectives. The yearly timber flow averages 330,000 m^3.

These are only two potential futures - many others are being explored. By setting a goal for a desired future forest that is acceptable to a broad range of values and using advanced tools to illustrate "what it might mean", the realistic future possibilities are made clearer - and which direction management should go to realize them is more defined. Using adaptive management techniques such as indicator monitoring (the "accountability" part of the McGregor's management system), it's possible to ensure that when a desired management strategy is implemented, it can be continually improved and adjusted to reflect changing conditions, objectives and new understandings.

Alberta Forest Management Science Council

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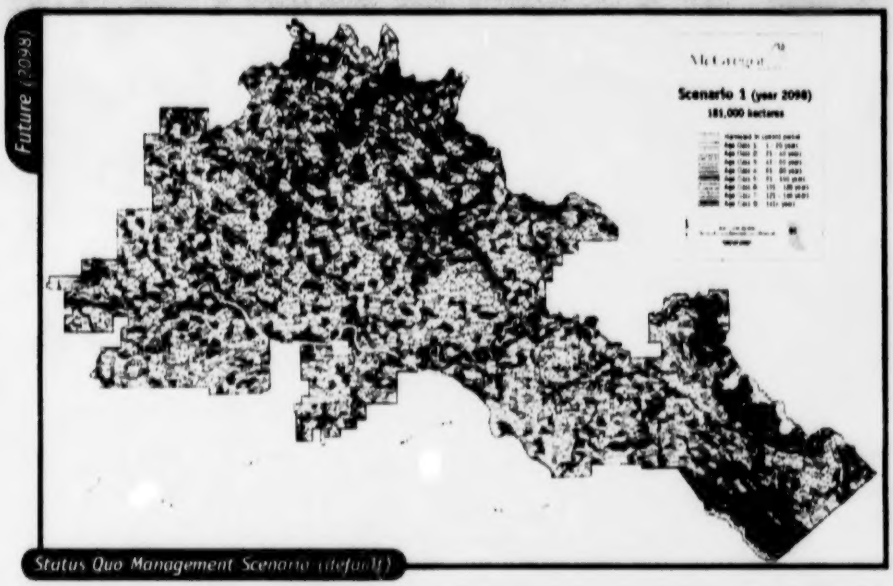
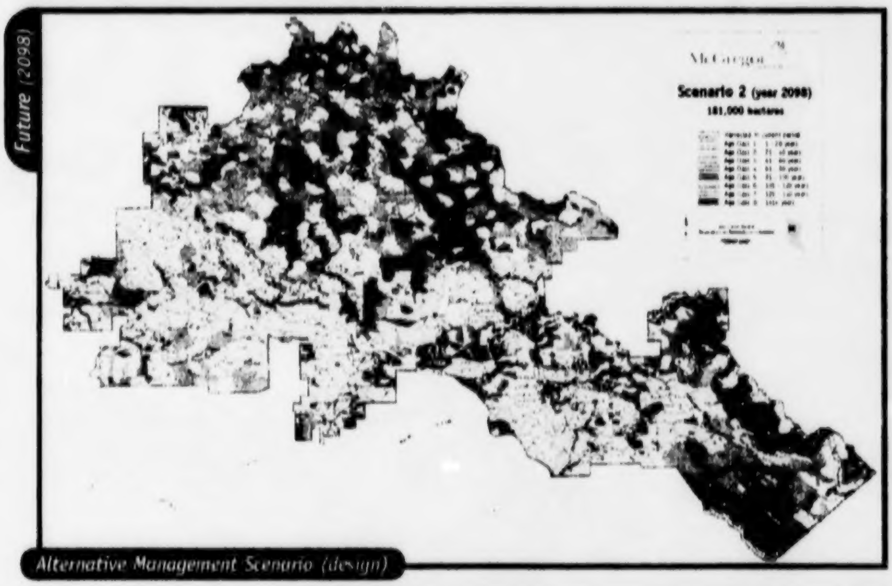
Balancing Sustainable Forest Management in Alberta

Shown here are GIS outputs of two different 100 year planning horizon scenarios projected using the McGregor's spatially-explicit computer models.



Status Quo Management Scenario (default)



Alternative Management Scenario (design)

The McGregor is part of Canada's Model Forest Network... an initiative of the Canadian Forest Service.

Cost/Benefit Assessment

The Model Forest example is not yet able to generate a clear cost/benefit assessment. Normal cost/benefit practices as determined by a qualified economist should be followed.

Implementation Steps to a Desired Future Forest

The steps outlined here are basic. They are intended only as a synopsis of the activities that must be undertaken to go towards a desired future forest. These items are generic in nature and reflect good planning practice. Additional steps are likely to be required when the actual desired future forest is implemented.

In the 1st year

Critical to success in subsequent years is the setting of a climate for change amongst the users of the Desired Future Forest. This is where the co-operation that has been built during the desire future forest development can provide for optimal implementation.

Three critical activities should be considered:

1. The development of criteria on which to measure success in transitions leading to the Desired Future Forest

2. The development of a transition protocol that does not impose undue hardship or undue advantage to users affected by the adoption of the Desired Future Forest. Co-operation is a key ingredient to the development of such a plan.

3. Development of a set of multiple use ground rules that clearly addresses the activities that require change from the perspective of each user.

Communication of the protocol, groundrules and criteria for success with users is important. Changes in business practice can proceed in an orderly manner if these three elements are done well and a spirit of co-operation developed.

In the 2nd year

In the second year critical issues may include:

1. The developing of a monitoring program based on the criteria for success.

2. Development of Business plans for users that are consistent with the Desired Future Forest.

3. Development of a Research program that supports the understanding required to attain the Desired Future forest.

Only after these elements are defined should changes be made to forest practices.

An Assessment of the Costs and Benefits of a Desired Future Forest process in Alberta

Contemporary forest management includes many of the costs of applying the desired future forest concept. Scientifically sound processes for public involvement, planning, inventory and reforestation are integral elements of today's forest management. However, today's forest management remains sectoralized with companies, traditional users and new users focused on their own purpose for use rather than a desired future forest.

Benefits

A significant benefit of the desired future forest is the design process that addresses benefits across a broad set of values rather than sector-specific values such as timber or traditional values. Forecast of future forest conditions, flows and stocks will address the sustainability of ecological processes and outcomes of management. Adaptive management focussed on the delivery of a desired future forest will test the feasibility of the forecast. As a result of the focus on a desired future forest, regulation of users will change and become one of the activities of monitoring and evaluation rather than a separate, punitive process as it has become in some jurisdictions.

By regularly reviewing outcomes and their relation to the forecast, the Council expects that conflict over differing resource expectations will decrease. Literature has shown that a recurring process reduces conflict.

Alberta will also be able to develop a better technology base as a result of adopting the Desired Future Forest concept. Alberta has made significant investments in digital terrain mapping and models and are developing new technologies for inventory and forecasting. The Province has also developed a very co-operative relationship with its major industrial partners and its primary research organizations. The increasing focus of Alberta's research community on the forest may lead to exportable technology development.

In our view, Alberta has the capability to apply the concept of a desired future forest.

Costs

Other provinces are exploring the desired future forest concept, notably Ontario, who have entrenched it in their legislation. No province has developed a process like we envision. The cost of undertaking a pilot desired future forest process should be compared not only to contemporary forest management in Alberta but also to potential outcomes if previous ways of managing forest were adopted. For example, Finland has over 1600 species at risk; the forests of the Pacific Northwest in the United States have undergone significant confrontation and controversy. The desired future forest concept, if applied in Alberta, can do much better.

Recommendation

The Alberta Forest Management Science Council recommends to the Government of Alberta that a desired future forest concept be adopted by the Province as an important element in its objective of Sustainable Forest Management and that a pilot be undertaken.

References

Alberta Forest Management Science Council, 1997. Sustainable Forest Management and Its Major Elements; Advice to the Land and Forest Service on Timber Supply Protocols. Alberta Environmental Protection.

Alberta Environmental Protection, 1996. The Status of Alberta's Timber Supply. Alberta Environmental Protection Publ. No. T/325; ISBN: 0-7732-5026-3

Murphy, P., Personal Communication. Professor Emeritus, Department of Renewable Resources, University of Alberta.

Appendix I : Some elements of a companion document

Location of DFF: boundaries delineated and reasons given for choice of boundaries.

Partnerships: List of co-operating industries, agencies, users, and groups. Must include forest companies, oil and gas representatives, agriculturists (if relevant), representatives of other extractive resource users (e.g. mining), recreational users, hunters, trappers, environmental groups, representatives of local communities including Aboriginal Peoples

Processes:

- an outline of the public/stakeholder participation process. That outline should include the following Elements:

- detailed overview of the model used, deterministic and stochastic relationships used and assumptions of the model.

Inventory characterisation

- current age class distribution and species composition of forest, and inventory of other land and water types (wetlands, lakes, streams etc)
- current inventories of fish and wildlife resources, with particular reference to endangered, threatened species and species of concern.
- current status of lakes/streams (permanency, characteristics (e.g. fishless or with fish, level of eutrophication))
- current anthropogenic disturbances (maps required and summary statistics as to roading, seismic lines, pipelines, oil/gas wells, agriculture (including cattle grazing), logging, mining, etc), recreational areas (campsites, ATV use areas)
- description of historical natural disturbance regime for the area, rates and ranges of fire occurrence.
- position, size, composition of reference areas or benchmarks to be used in adaptive management.
- Characteristics of the human uses e.g. current population, demographic structure, recreation use inventory, etc

Goal

- A clear goal of what the DFF will be must be described showing the pathway of how this vision was achieved (input of scientists, public etc).

Planned uses of resources from area:

- timber
- fish and wildlife, by species
- oil and gas, minerals
- levels and patterns (temporal, spatial) of recreational activity and kinds (e.g. camper-days, hiker days, off-road vehicle days and kms, wilderness camping and hiking days,

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horse riding days and kms, areas of and intensity of use for each of these, temporal pattern of use for each (i.e. weekends vs weekdays, summer vs. other seasons etc)
- water quantity and quality and seasonal flows
- grazing AUMs, or ha of summer range, has of undisturbed winter range for wildlife and stock.
- amount of protected areas and state of protection

Changes in landscape pattern and stocks and states deriving from the planned flows:
- maps at 10 or 20 year intervals up to 100yr showing all stocks and states (as above)- this should show variation induced by stochasticity (e.g. big bang fire year)- i.e. what is the range of variation expected for stocks and states
- tables listing model outputs
- the onus will be on the preparers of the plan to demonstrate how their DFF contributes to the overarching goals for sustaining ecological integrity and biodiversity.

Planned management strategies:
- monitoring and inventory plans to assess stocks and states
- management strategies for sensitive species
- strategies for access management
- risk management (what will they do if there is a huge fire, blow down etc beyond what they have predicted?; what will they do if their monitoring shows that they are depleting some stocks too rapidly in comparison with their reference areas)

Research:
- a list of relationships from the model which are not well known and plans of how these will be tested through research, timelines must be given
- a list of untested assumptions of the model and how these will be tested. (given the large scale nature of many of these research questions, co-operation among stakeholders over large areas should be developed)
- a clear statement of how adaptive management will be used, including use of and location of reference areas.